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Indian Standard

SPECIFICATION FOR TOGGLE SWITCHES

PART I GENERAL REQUIREMENTS AND TESTS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR TOGGLE SWITCHES

PART I GENERAL REQUIREMENTS AND TESTS

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Indian Standard

SPECIFICATION FOR TOGGLE SWITCHES

PART I GENERAL REQUIREMENTS AND TESTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 26 March 1966, after the draft finalized by the Electromechanical Components for Electronic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard deals with the general requirements and tests for toggle switches. Detailed requirements (including dimensions) for various types of toggle swtiches will be covered in individual specifications under preparation.

0.3 The object ot establishing a series of standards on toggle switches is to specify uniform requirements for judging the mechanical, electrical and climatic properties as well as safety aspects, to describe test methods and to specify the dimensions for interchangeability and compatibility of toggle switches.

0.3.1 The switches used in electrical appliances and electrical wiring installations in buildings and other similar locations are not covered by this standard.

0.4 This standard is largely based on the corresponding recommendation of the International Electrotechnical Commission (IEC) as contained in Pub 131-1 (1962) 'Toggle switches: Part I General requirements and measuring methods'.

0.5 This standard requires reference to IS: 589-1961* so far as the details of the climatic and mechanical testing procedures are concerned; only the relevant degrees of severity and the performance requirements have been specified in this standard.

0.6 This standard is one of a series of Indian Standards on electromechanical components for electronic equipment. Other standards published so far in the series are:

IS: 2628(Part I)-1964 Specification for rotary wafer switches (low current rating): Part I Tests and general requirements

*Basic climatic and mechanical durability tests for electronic components (*revised*).

IS: 3354(Part I)-1965 Specification for valve sockets: Part I General requirements and tests

IS: 3354(Part II)-1965 Specification for valve sockets: Part II Dimensions and construction of gauges and tools

IS: 3544-1966 General requirements and tests for tag strips

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part I) prescribes general requirements and methods of tests for judging the mechanical, electrical and climatic properties of toggle switches intended for use in electronic and telecommunication equipment.

1.1.1 This standard does not cover the switches used in electrical appliances and in electrical wiring installations in buildings.

SECTION I TERMINOLOGY AND GENERAL REQUIREMENTS

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions hall apply.

2.1 Toggle Switch — A switch, the movement of the lever of which results in connection or disconnection of the switch terminations in a specified manner.

2.2 Position — A setting of the lever which results in a particular circuit condition. A position may be momentary or maintained when the lever is released.

2.3 Clearance — The shortest distance measured in air between conductive parts.

2.4 Creepage Distance — The shortest distance between conductive parts over the outer surface of insulation with the switch in any set position.

2.5 Electrical Ratings — The electrical ratings of a switch is given by the combination of maximum voltage and maximum current under which the switch shall operate satisfactorily in specified circuit conditions and at standard atmospheric conditions for testing.

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*Rules for rounding off numerical values (*revised*).

2.6 Rated Voltage and Rated Current — The voltage and current which are marked on the switch.

2.7 Type Tests — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general qualities and design of a given type of switch.

2.8 Acceptance Tests — Tests carried out on samples selected from a lot for purposes of verifying the acceptance of the lot.

2.8.1 *Lot* — All toggle switches of the same type, category and rating manufactured by the same factory during the same period, using the same process and materials.

2.8.2 *Type* — Identification given to variants of switches of the same designation, all switches of each such variant having similar design features and manufactured by the same techniques.

2.9 Routine Tests — Tests carried out on each switch to check requirements which are likely to vary during production.

3. CATEGORIES

3.1 There shall be three categories corresponding to three climatic severities as detailed below:

Climatic Test (*see* IS: 589-1961*)	*Severity*		
	Category I	Category II	Category III
Dry heat	100°C	85°C	70°C
Cold	−55°C	−40°C	−10°C
Damp heat (long term)	56 days	56 days	21 days
Damp heat (accelerated)	6 cycles	6 cycles	2 cycles
Rapid change of temperature	+100°C to −55°C	+85°C to −40°C	Not applicable
Low air pressure	44 mbar	300 mbar	600 mbar

NOTE 1 — In case of special requirements where the above categories cannot be applied, different combinations of climatic severities may be agreed to between the purchaser and the supplier provided that the degrees of severity are chosen from those specified in IS: 589-1961*.

NOTE 2 — A recovery period of 24 hours after the damp heat accelerated and damp heat long term tests is necessary for category III components.

4. MATERIALS AND WORKMANSHIP

4.1 Materials — The switches shall be constructed from the most suitable materials which shall be free from flaws and shall conform to the relevant Indian Standard specifications, if any. All materials used

*Basic climatic and mechanical durability tests for electronic components (*revised*).

in the construction of the toggle switches shall be such as are not susceptible to any mutual chemical reaction over the entire range of temperature for which the switches are designed.

4.2 Workmanship — All parts of the switch shall be manufactured and processed in a careful and workmanlike manner in accordance with the best current practice.

5. ELECTRICAL RATINGS

5.1 The relevant specifications for toggle switches shall include the following electrical details:

a) Maximum voltage,
b) Maximum current, and
c) Circuit conditions and associated combinations of voltage and current.

6. MARKING

6.1 Each switch shall be clearly marked with the following information, whenever relevant, in the order given below:

a) Rated voltage, rated current and type of current;
b) Manufacturer's type number;
c) Manufacturer's name and/or trade-mark;
d) Any additional requirements, if required by the purchaser or any other marking agreed to by the manufacturer and the purchaser; and
e) Country of manufacture.

NOTE — Marking details shall be specified in the relevant specification.

6.1.1 The package of the switch shall contain information about the category, sealed or unsealed and reference to relevant specification in addition to those specified in **6.1**.

6.2 Any additional marking on the toggle switches and its packing shall be so applied as not to cause confusion.

6.2.1 The switches or their packing may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI

Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

SECTION 2 TESTS

7. CLASSIFICATION OF TESTS

7.1 Type Tests — The procedure for type tests shall be in accordance with IS: 2612-1965*.

7.1.1 *Number of Samples* — The minimum number of samples for type tests shall be 24 of each category pertaining to each type of the toggle switch.

7.1.2 *Sequence of Type Tests* — The sequence of type tests shall be in accordance with Appendix A.

7.2 Routine Tests

7.2.1 Every switch shall be subjected to test for general examination (*see* **9**).

7.3 Acceptance Tests

7.3.1 Acceptance tests shall be carried out on a limited number of samples which have passed the routine test and selected in accordance with the sampling procedure given in IS: 2612-1965*.

7.3.2 Two groups of samples, one for non-destructive tests (Group A) and the other for destructive tests (Group B), shall be selected (*see* Appendix B of IS: 2612-1965*) and the switches in each group shall be subjected to the following tests:

Group A (*Non-destructive*)

a) Contact resistance,
b) Voltage proof,
c) Insulation resistance, and
d) Sealing (for sealed types only).

Group B (*Destructive*)

a) Dimensions,
b) Steady load,
c) Terminal strength,
d) Soldering,
e) Bumping,
f) Overload, and
g) Climatic sequence.

*Recommendations for type approval and sampling procedures for electronic components.

8. CONDITIONS FOR TESTS

8.1 General — The tests shall be carried out on the switches as received from the manufacturer or the supplier. In no case shall the contact parts be cleaned or otherwise prepared prior to the tests unless explicitly so agreed.

8.2 Mounting — Where mounting is specified in a test, the switches shall be rigidly mounted on a metal plate using its normal fixing device, the dimensions of the mounting plate being such that the contour of the specimen under test is exceeded.

8.3 Selection of Samples — The samples for testing shall be so selected as to be representative of each category of the relevant type of toggle switches.

8.4 Atmospheric Conditions for Testing — Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing specified in IS: 589-1961*.

8.5 Preconditioning — Before measurements are made, the switches shall be stored at the measuring temperature for a time sufficient to allow the entire switch to reach that temperature. The recovery period called for after conditioning is adequate for this purpose.

8.6 Correction to be Applied — When measurements are made at an ambient temperature other than the reference temperature, the results shall, where necessary, be corrected to the reference temperature. The ambient temperature during the test shall be stated in the test report.

8.7 Other Precautions — During measurements, the switches shall not be exposed to draughts, direct sun rays or other influences likely to cause errors.

9. GENERAL EXAMINATION

9.1 The toggle switches shall be visually examined for conformity with **9.1.1** to **9.1.3**.

9.1.1 The marking shall be in accordance with **6**.

9.1.2 The switches shall be complete and workmanship, finish and assembly shall be satisfactory. The visual examination shall also include a check that the switch is mechanically operable.

9.1.3 Each locking nut shall have a well-formed full thread and shall be a good running fit on the fixing bush.

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*Basic climatic and mechanical durability tests for electronic components (*revised*).

9.2 There shall be no deterioration (in the features mentioned in **9.1.1** to **9.1.3**) after mechanical, electrical and climatic tests.

10. DIMENSIONS

10.1 The dimensions of the switch shall be checked. This shall be in accordance with those specified in the relevant specification for the relevant types of toggle switches.

11. ELECTRICAL TESTS

11.1 Contact Resistance

11.1.0 Two measuring voltages are specified for the measurement of contact resistance. Applicable test voltage shall be indicated in the relevant specification for toggle switches.

11.1.1 *General Measuring Requirements* — Measurement may be carried out with direct current or alternating current. In the case of dispute, the dc measurement shall govern. The contact resistance shall normally be calculated from the potential difference measured between the points intended for connection of the wiring. The contact shall be made before the measuring voltage is applied. In order to prevent undue heating of the contacts, the current flowing shall not exceed 1 A or the value specified in the relevant specification. For ac measurements, the frequency shall be 1 000 $\overline{+}$ 200 c/s. The measuring apparatus shall be such as to ensure an accuracy of $\pm$10 percent.

11.1.2 *Measuring Voltage* — Either of the following voltage shall be applied as called for in the relevant specification:

a) emf of the measuring circuit shall not exceed 2·5 V (dc or ac peak)
b) emf of the measuring circuit shall not exceed 20 mV (dc or ac peak)

NOTE — The low level measurement is carried out in order to prevent the breakdown of insulating films on the contacts.

11.1.3 *Measuring Cycle*

11.1.3.1 *Measurement with dc* — One measuring cycle consists of:

a) Making the contact,
b) Connection of voltage source,
c) Measurement with current flowing in one direction,
d) Measurement with current flowing in opposite direction,
e) Disconnection of voltage source, and
f) Breaking the contact.

11.1.3.2 *Measurement with ac* — One measuring cycle consists of:

a) Making the contact,
b) Connection of voltage source,
c) Measurement,
d) Disconnection of voltage source, and
e) Breaking the contact.

11.1.3.3 The measuring cycles shall be carried out in immediate succession.

11.1.4 *Measurement* — The contact resistance shall be measured between any pair of terminations that are connected by the contacting device. There shall be five measuring cycles.

11.1.5 *Requirements* — The value of the contact resistance for any individual measurement shall not exceed the value specified in the relevant specification.

NOTE — For low current contacts for use in the microvolt range, modifications of the measuring method and/or special requirements may be specified in the relevant specification.

11.2 Insulation Resistance

11.2.1 Toggle switches shall be mounted as specified in **8.2** and the insulation resistance measured between the following points:

a) Mounting plate and all parts intended to be electrically insulated from it connected together, and
b) Adjacent parts intended to be electrically insulated from each other.

11.2.2 The measuring voltage shall be a dc voltage of 500 $\pm$50 V or 100 $\pm$15 V as specified in the relevant specification and shall be applied for a period of 1 minute $\pm$5 seconds.

11.2.3 The insulation resistance shall be not less than those specified in the relevant specification.

11.3 Voltage Proof

11.3.1 Toggle switches shall be mounted in the normal manner as specified in **8.2**.

11.3.2 An ac test voltage of three times the maximum voltage or 500 V, whichever is higher (unless otherwise specified in the relevant specification) shall be applied for a period of one minute between the terminations chosen for the insulation resistance test (*see* **11.2**).

11.3.3 The switches shall withstand the application of the voltage without breakdown or flashover.

11.4 Capacitance Test

11.4.1 The switches shall be mounted as specified in **8.2.**

11.4.2 The capacitance shall be measured between:

a) any two adjacent terminations which are not electrically connected permanently, and
b) each termination and all other metal parts.

11.4.3 Unless otherwise specified, the capacitance shall be measured at 1 Mc/s $\pm$ 200c/s.

11.4.4 The value of the capacitance as measured between the specified terminations shall not exceed the limits laid down in the relevant specification.

11.4.5 All subsequent measurement of capacitance after various other tests shall be repeated on the same pair of contacts as selected in **11.4.2.**

11.5 Radio Frequency Shunt Resistance (Parallel Damping)

11.5.1 The toggle switches shall be mounted as specified in **8.2.**

11.5.2 The radio frequency shunt resistance shall be measured at a frequency between two contacts specified in the relevant specification.

11.5.3 The measuring method shall be chosen so as to ensure accuracy of $\pm$ 10 percent.

11.5.4 The value of radio frequency resistance shall be not less than that specified in the relevant specification.

11.6 Noise — Under consideration.

11.7 Overload Test

11.7.1 The switch shall be operated mechanically for 50 cycles at a rate of five to six cycles per minute to make and break the current specified in **11.7.2.** A cycle consists of moving the lever from one end position through all other positions and return to the end position.

11.7.1.1 Return from momentarily actuated positions shall be accomplished solely by the internal switch mechanism.

11.7.1.2 For double throw switches, one-half of the switches shall be tested with the circuit connected to one set of contacts and the remaining half with the circuit connected to the other set of contacts.

11.7.1.3 For multipole switches, each pole of the switch shall be tested simultaneously with the other pole(s).

11.7.2 The following two tests shall be carried out in resistive circuits, separate components being used for each test:

a) With the minimum dc voltage and twice the associated current, and

b) With the maximum ac voltage and twice the associated current.

11.7.2.1 For both tests, the duty cycle shall be approximately 50 percent 'on' and 50 percent 'off'.

11.7.3 The switches shall then be subjected to the following tests in the order indicated; and shall meet the requirements specified in the relevant specification:

a) Contact resistance,
b) Insulation resistance, and
c) Sealing (for sealed switches only).

12. MECHANICAL TESTS

12.1 Operating Force

12.1.1 The switch shall be mounted as specified in **8.2.**

12.1.2 The force necessary to move the lever from any position to another shall be measured.

12.1.3 The measured value of operating force shall lie within the limits specified in the relevant specification.

12.2 Impact Test on Actuating Lever

12.2.1 The switches shall be mounted rigidly in the normal manner as specified in **8.2.**

12.2.2 The mechanical strength of the lever is tested with the aid of an impact test apparatus. The striking element of the apparatus is a hammer with a hemispherical face made of hard wood, the radius of the sphere being 10 mm. With the aid of the apparatus 10 blows are applied to the lever, the impact energy in each blow being 5·5 kgf/cm, unless otherwise specified in the relevant specification.

12.2.3 After the test, there shall be no sign of deterioration and the switch shall still be mechanically operable.

12.3 Steady-Load on Actuating Lever

12.3.1 The switches shall be mounted rigidly in the normal manner as specified in **8.2.**

12.3.2 A force of 10 kgf shall be applied to the tip of the actuating lever for 1 minute under each of the following conditions:

a) Perpendicular to the lever axis and in the plane of lever travel and at each end position of the lever,
b) Perpendicular to the lever axis and perpendicular to the plane of lever travel at each position of the lever,

c) Axially with the lever axis towards the lever pivot, and
d) Axially with the lever axis away from the lever pivot.

12.3.3 The torque shall be applied to the lever for one minute in either direction. The value of the torque shall be $1{\cdot}0 \times d$ kgf.cm, where d is the maximum diameter of the lever in millimetres.

12.3.4 After the test, there shall be no sign of deterioration and the switch shall still be mechanically operable.

12.4 Robustness of Terminations

12.4.1 This test shall be carried out in accordance with **7.19.1** of IS: 589-1961*, the loading weight being as specified in the relevant specification.

12.4.2 There shall be no sign of failure and the switch shall still be mechanically operable.

12.5 Switching Mechanism Test

12.5.1 The correct functioning of the switching mechanism shall be checked by setting the lever within the specified angle from the theoretical position. The switching mechanism shall then cause the switch to operate correctly. This operation shall be carried out in each appropriate direction for each specified position.

12.6 Soldering

12.6.1 The switches shall be subjected to the soldering iron test in accordance with **7.18.3** of IS: 589-1961*.

12.6.1.1 The period of recovery shall be as specified in the relevant specification.

12.6.2 After the test, the switches shall be visually examined and there shall be no fracture, loosening of parts or any other mechanical failure.

12.7 Vibration

12.7.1 The switches shall be mounted in the normal manner on a vibration table and subjected to the vibration test in accordance with **7.6** of IS: 589-1961*.

12.7.1.1 During the vibration test, continuous monitoring shall be carried out to determine the intermittency of electrical contact by applying the voltage and current used for contact resistance measurement.

NOTE — A typical method of continuous monitoring is under consideration.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

12.7.2 There shall be no loosening of parts or any other mechanical failure. The fixing shall not become loose.

12.7.3 The contact resistance shall be measured as in **11.1** after the test and the values shall not exceed the limits specified in the relevant specification.

12.8 Acceleration — The switches shall be mounted in the normal manner on a table of acceleration test machine. During the test, the electrical continuity shall be continuously monitored. There shall be no intermittency electrical continuity of duration greater than that specified in the relevant individual specification.

NOTE — A continuous monitoring circuit is under consideration.

12.8.1 The switches shall be subjected to the acceleration test in accordance with **7.7** of IS : 589-1961*. The severities of acceleration shall be as specified in the relevant specification.

12.8.2 The duration of the acceleration test in each case shall be 8 minutes.

12.8.3 During the acceleration test, there shall be no spurious operation. After the acceleration test, the switches shall be visually examined and there shall be no fracture or loosening of parts or any other mechanical failure. The fixing shall not become loose.

12.8.4 The contact resistance shall then be measured and the value of the contact resistance shall not exceed the limit specified in the relevant specification.

12.9 Shock — The component shall be mounted on the moving table of shock test apparatus in its three principle axes in turn and subjected to the shock test in accordance with **7.5.2** of IS : 589-1961*.

12.9.1 During the test, electrical continuity shall be continuously monitored. There shall be no intermittency of electrical continuity of duration greater than that specified in the relevant individual specification. (This is not applicable for category 3 components.)

12.9.2 During the shock test, there shall be no spurious operation. After shock test the components shall be visually examined and there shall be no fracture or loosening of parts or other mechanical failure. The fixing shall not become loose.

12.9.3 The contact resistance shall be measured and the value shall not exceed the limits specified in the relevant specification.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

12.10 Bump — The component shall be mounted in the normal manner on a table of bump test machine in accordance with **7.5** of IS : 589-1961*.

12.10.1 The component shall then be subjected to the bump test in accordance with **7.5.1** of IS : 589-1961* for 4 000 bumps.

12.10.2 During the test, the electrical continuity shall be continuously monitored. There shall be no intermittency of electrical continuity of duration greater than that specified in the relevant specification.

12.10.3 After the bump test, a component shall be visually examined and there shall be no fracture or loosening of parts or other mechanical failure. The fixing shall not become loose.

12.10.4 The contact resistance shall be measured and the value shall not exceed the limits specified in the relevant individual specification.

13. CLIMATIC TESTS

13.1 Preconditioning — The switches shall be preconditioned as specified in **8.5**.

13.2 Climatic Sequence

13.2.1 *Dry Heat*

13.2.1.1 The switches shall be subjected to the dry heat test in accordance with **7.2** of IS : 589-1961*.

13.2.1.2 The temperature of the test chamber shall be maintained at the appropriate maximum value for the category.

13.2.1.3 At the end of the period of conditioning and while still at the high temperature, the insulation resistance shall be measured. The value of the insulation resistance shall be not less than that specified in the relevant specification.

13.2.1.4 While at the high temperature, the switches shall be mechanically operable.

13.2.1.5 The switches shall then be removed from the dry heat chamber and allowed to remain under standard recovery conditions.

13.2.2 *Damp Heat (Accelerated) First Cycle*

13.2.2.1 This test shall be carried out in accordance with **7.4** of IS : 589-1961*.

13.2.2.2 After the specified period of conditioning, the switches shall be removed from the chamber and allowed to recover under conditions appropriate to the test and then visually examined.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

13.2.2.3 There shall be no visible damage to the switch. The marking shall be legible and indelible.

13.2.3 *Cold*

13.2.3.1 This test shall be carried out in accordance with **7.1** of IS: 589-1961*.

13.2.3.2 The temperature of the chamber shall be maintained at the appropriate minimum value for the category of the switch under test and the duration of the exposure shall be two hours.

13.2.3.3 At the end of this period, and while still at the low temperature, there shall be a check to see that the switch is mechanically operable.

13.2.3.4 The capacitance shall be measured in accordance with **11.4** and shall be within the limits specified in the relevant specification.

13.2.3.5 The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to this test.

13.2.4 *Low Air Pressure*

13.2.4.1 This test shall be carried out in accordance with **7.12** of IS: 589-1961*.

13.2.4.2 The test chamber shall be maintained at a temperature of 15° to 35°C and at a pressure appropriate to the category of the switch; the duration of the test shall be five minutes.

13.2.4.3 During the conditioning, a dc or ac (peak) voltage of twice the maximum voltage (for low air pressure), as specified in the relevant specification, shall be applied between the points mentioned in **11.2.1**.

13.2.4.4 During and after this test, there shall be no sign of glow discharge, breakdown, flashover or harmful deformation of the switch.

13.2.5 *Damp Heat (Accelerated) Remaining Cycles*

13.2.5.1 This test shall be carried out in accordance with **7.4** of IS: 589-1961* for the remaining number of cycle(s) appropriate to the category of the switch.

NOTE — The remaining damp heat cycles required are as follows:

Category I — 5 cycles
Category II — 5 cycles
Category III — 1 cycle

*Basic climatic and mechanical durability tests for electronic components (*revised*).

13.2.5.2 At the end of the specified number of cycles, the switches shall be removed from the chamber and allowed to recover under recovery conditions appropriate to this test except for Category III for which the recovery period shall be 24 hours.

13.2.5.3 The switches shall then be subjected to the following tests in the order indicated and shall meet the requirements specified in the relevant specification:

a) Contact resistance,
b) Insulation resistance,
c) Voltage proof,
d) Capacitance, and
e) Visual inspection.

13.3 Damp Heat (Long Term Exposure)

13.3.1 The switches shall be subjected to this test in accordance with **7.3** of IS: 589-1961*.

13.3.2 The duration of the exposure shall be appropriate to the category of the switch.

13.3.3 During conditioning, a polarizing voltage shall be applied between:

a) two adjacent terminations having minimum spacing; and
b) all remaining terminations connected together and all other metal parts.

13.3.3.1 The positive potential shall be applied to the terminations. The value of the polarizing voltage shall be 15 V dc unless otherwise specified.

13.3.4 At the end of the period of exposure, the switches shall be removed from the chamber and allowed to remain under recovery conditions appropriate to this test except for Category III switches for which the recovery period shall be 24 hours.

13.3.5 The switches shall then be subjected to the test specified in **13.2.5.3** and shall meet the requirements specified in the relevant specification.

13.4 Rapid Change of Temperature

13.4.0 This test is applicable only to toggle switches of Category I and Category II.

13.4.1 The switches shall be subjected to this test in accordance with **7.14** of IS: 589-1961*.

*Basic climatic and mechanical durability tests for electronic components *(revised)*.

13.4.2 The maximum and minimum temperature shall be appropriate to the category of the switch. The total number of cycles shall be five.

13.4.3 After the exposure, the switches shall be removed from the chamber and allowed to remain under recovery conditions appropriate to this test.

13.4.4 The switches shall then be subjected to the tests mentioned in **13.2.5.3** and shall meet the requirements speecified in the relevant specification.

13.5 Sealing (For Sealed Types Only)

13.5.1 *Sealing (Normal)*

13.5.1.1 This test shall be carried out in accordance with **7.15.2** of IS: 589-1961*.

13.5.1.2 The rate of leakage of air shall not exceed the values specified in the relevant specification.

13.5.2 *Sealing (Extended)*

13.5.2.1 This test shall be carried out in accordance with **7.15.3** of IS: 589-1961*.

13.5.2.2 The rate of leakage of air shall not exceed the value specified in the relevant specification.

13.6 Salt Mist

13.6.1 The switches shall be mounted normally as specified in **8.2**.

13.6.2 This test shall be carried out in accordance with **7.10** of IS: 589-1961*, the period of exposure being four days.

13.6.3 After the specified period of exposure, the switches shall be allowed to recover under the recovery conditions appropriate to this test.

13.6.4 The switches shall then be subjected to the tests mentioned in **13.2.5.3** and shall meet the appropriate requirements as laid down in the relevant specification.

13.7 Mould Growth

13.7.1 This test shall be carried out in accordance with **7.9** of IS: 589-1961*.

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*Basic climatic and mechanical durability tests for electronic components (*revised*).

13.7.2 After the expiry of the specified period of exposure, there shall be no mould growth on the switches visible to the naked eye.

13.8 Dust — Under consideration.

14. ENDURANCE TEST

14.0 Two tests have been specified, the first one being applicable to switches of Categories I and II while the second test is applicable to switches of Category III

14.1 Endurance Test for Category I and Category II Switches

14.1.1 This test shall be carried out at the appropriate maximum category temperature. The switches shall remain in the chamber for a total period of 2000 hours. During the latter part of the 2000 hours period, the switches shall be operated mechanically to make and break the currents specified in **14.1.2** at a rate of 10 to 12 cycles per minute.

14.1.1.1 A cycle consists of moving the lever from one end position through all other positions and return to the end position.

14.1.1.2 Return from momentarily actuated positions shall be accomplished solely by the internal switch mechanism.

14.1.1.3 For double-throw switches, one-half of the switches shall be tested with the circuit connected to one set of contacts and the remaining half with the circuit connected to the other set of contacts.

14.1.1.4 For multipole switches, each pole of the switch shall be tested simultaneously with the other pole(s).

14.1.2 The following tests shall be carried out on separate switches, 10 000 cycles being performed in each case (*see* **14.1.1**):

a) *Inductive Circuit* — The test shall be carried out using an inductive circuit with the dc voltage and the current as specified in the relevant specification. The circuit used for this test shall have a time constant between 2 and 3 seconds. The duty cycle shall be approximately 25 percent ' on ' and 75 percent ' off '.

b) *Lamp Load* — The test shall be carried out using a lamp load with dc voltage and the current as specified in the relevant specification. Only tungsten lamps having a nominal power of 25 W at the voltage specified in the relevant specification shall be used for the load. The duty cycle shall be approximately 25 percent ' on ' and 75 percent ' off '.

c) *Resistive Circuit* — The test shall be carried out using a resistive circuit with the ac voltage and the current as specified in

the relevant specification. The duty cycle shall be approximately 50 percent ' on ' and 50 percent ' off '

14.1.3 The switches shall then be subjected to the following tests in the order indicated and shall meet the requirements specified in the relevant specification:

a) Impact test on actuating lever,
b) Steady load test on actuating lever,
c) Contact resistance,
d) Insulation resistance,
e) Voltage proof, and
f) General examination.

14.2 Endurance Test for Category III Switches

14.2.1 The switches shall be operated mechanically to make and break the currents specified in **14.2.2** at a rate of 10 to 12 cycles per minute.

14.2.1.1 A cycle shall consist of moving the lever from one end position through all other positions and return to the same end position.

14.2.1.2 Return from momentarily actuated positions shall be accomplished solely by the internal switch mechanism.

14.2.1.3 For double-throw switches, one-half of the switches shall be tested with the circuit connected to one set of contacts and the remaining half with the circuit connected to the other set of contacts.

14.2.1.4 For multipole switches, each pole of the switch shall be tested simultaneously with the other pole(s).

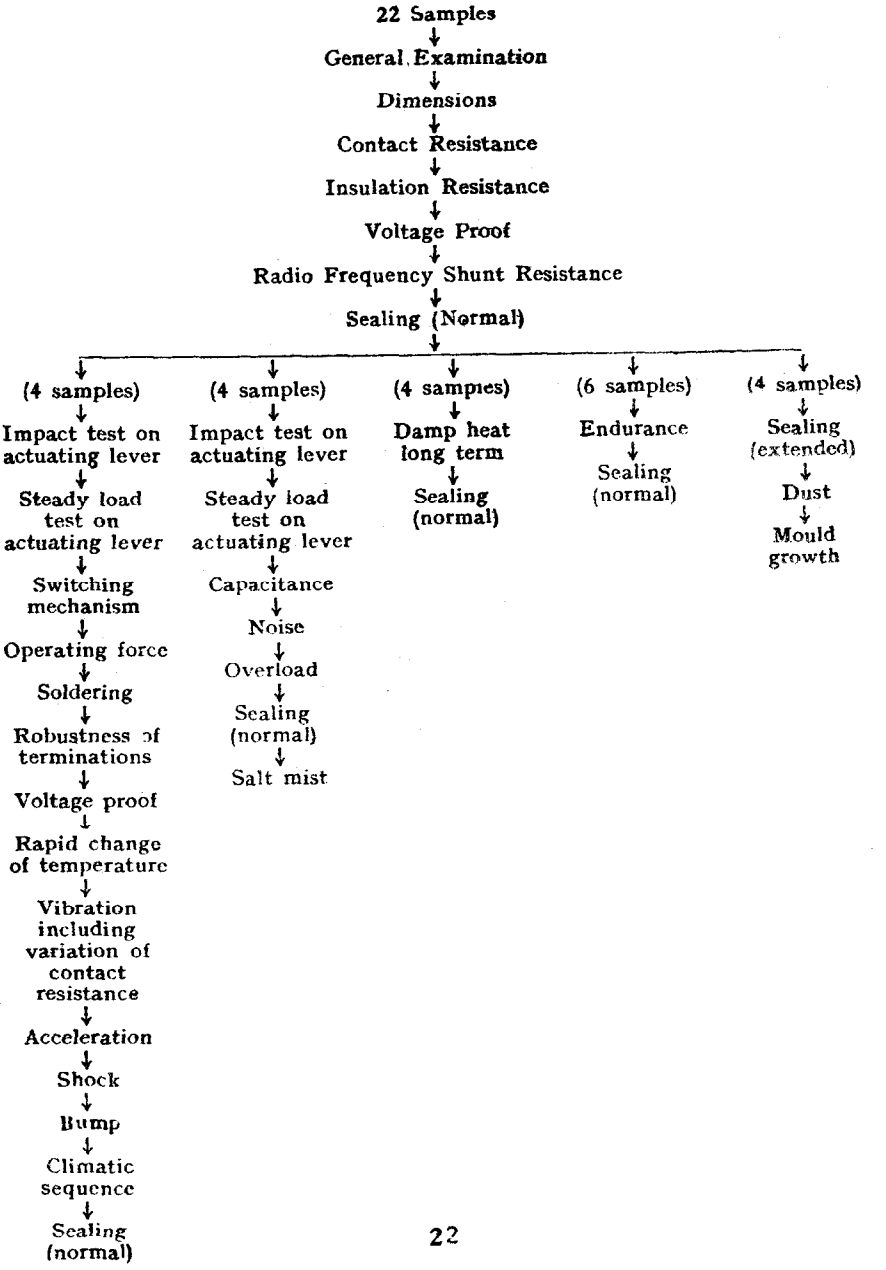
14.2.2 The tests specified in **14.1.2** shall be carried out on separate switches, 10 000 cycles being performed in each case.

14.2.2.1 The switches shall then be subjected to tests specified in **14.1.3** and shall meet the requirements specified in the relevant specification.

APPENDIX A

(*Clause* 7.1.2)

SEQUENCE OF TYPE TESTS



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Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 JUNE 1991

TO

IS 3452 (Part 1) : 1966 SPECIFICATION FOR TOGGLE SWITCHES

PART 1 GENERAL REQUIREMENTS AND TESTS

(*Page* 4, *clause* **0.5**, *line* 1) — Substitute 'IS : 9000*' *for* 'IS 589 : 1961'.

(*Page* 4, *foot-note with* '*' *mark*) — Substitute the following for the existing foot-note:

'*Basic environmental testing procedures for electronic and electrical items.'

(*Page* 6, *clause* **3.1**, *Below climatic test and Note* 1, *line* 4) — Substitute 'IS 9000 (Part 1) : 1988*' *for* 'IS 589 : 1961'.

(*Page* 6, *foot-note with* '*' *mark*) — Substitute the following for the existing foot-note:

'*Basic environmental testing procedures for electronic and electrical items : Part 1 General.'

(*Page* 9, *clause* **8.4**, *line* 3) — Substitute 'IS 9000 (Part 1) : 1988*' *for* 'IS 589 : 1961'.

(*Page* 9, *foot-note with* '*' *mark*) — Substitute the following for the existing foot-note:

'*Basic environmental testing procedures for electronic and electrical items: Part 1 General.'

(*Page* 14, *clause* **12.4.1**, *lines* 1 *and* 2) — Substitute 'IS 9000 (Part 19) : 1986*' *for* '**7.19.1** of IS 589 : 1961'.

(*Page* 14, *clause* **12.6.1**, *line* 2) — Substitute 'IS 9000 (Part 18) : 1981†' *for* '**7.18.3** of IS 589 : 1961'.

(*Page* 14, *clause* **12.7.1**, *line* 3) — Substitute 'IS 9000 (Part 8) : 1985‡' *for* '**7.6** of IS 589 : 1961'.

(*Page* 14, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items : Part 19 Robustness of terminations and integral mounting devices.

†Basic environmental testing procedures for electronic and electrical items : Part 18 Solderability test.

‡Basic environmental testing procedures for electronic and electrical items : Part 8 Vibration (sinusoidal) test.'

(*Page* 15, *clause* **12.8.1**, *line* 2) — Substitute 'IS 9000 (Part 9) : 1981*' *for* '**7.7** of IS 589 : 1961'.

(*Page* 15, *clause* **12.9**, *line* 3) — Substitute 'IS 9000 (Part 7/Sec 1) : 1979†' *for* '**7.5.2** of IS 589 : 1961'.

(*Page* 15, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items : Part 9 Acceleration (steady state).

†Basic environmental testing procedures for electronic and electrical items : Part 7 Impact test, Sec 1 Shock.'

(*Page* 15, *clauses* **12.10** *and* **12.10.1**, *line* 2) — Substitute 'IS 9000 (Part 7/Sec 2) : 1979*' *for* '**7.5** and **7.5.1** of IS 589 : 1961'.

(*Page* 15, *clause* **13.2.1.1**, *line* 2) — Substitute 'IS 9000 (Part 3) : 1977†' *for* '**7.2** of IS 589 : 1961'.

(*Page* 15, *clause* **13.2.2.1**, *line* 2) — Substitute 'IS 9000 (Part 5) : 1981‡' *for* '**7.4** of IS 589 : 1961'.

(*Page* 15, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items : Part 7 Impact test, Sec 2 Bump.

†Basic environmental testing procedures for electronic and electrical items : Part 3 Dry heat test.

‡Basic environmental testing procedures for electronic and electrical items : Part 5 Damp heat cyclic test.'

(*Page* 16, *clause* **13.2.3.1**, *lines* 1 *and* 2) — Substitute 'IS 9000 (Part 2) : 1977*' *for* '**7.1** of IS 589 : 1961'.

(*Page* 16, *clause* **13.2.4.1**, *line* 2) — Substitute 'IS 9000 (Part 13) : 1981†' *for* '**7.12** of IS 589 : 1961'.

(*Page* 16, *clause* **13.2.5.1**, *lines* 1 *and* 2) — Substitute 'IS 9000 (Part 5) : 1981‡' *for* '**7.4** of IS 589 : 1961'.

(*Page* 16, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items: Part 2 Cold test.

†Basic environmental testing procedures for electronic and electrical items: Part 13 Low air pressure test.

‡Basic environmental testing procedures for electronic and electrical items : Part 5 Damp heat (cyclic) test.'

(*Page* 17, *clause* **13.3.1**, *line* 2) — Substitute 'IS 9000 (Part 4) : 1979*' *for* '**7.3** of IS 589 : 1961'.

(*Page* 17, *clause* **13.4.1**, *line* 2) — Substitute 'IS 9000 (Part 14) : 1988†' *for* '**7.14** of IS 589 : 1961'.

(*Page* 17, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items : Part 4 Damp heat steady state.

†Basic environmental testing procedures for electronic and electrical items : Part 14 Change of temperature.'

(*Page* 18, *clause* **13.5.1.1**, *line* 2) — Substitute 'IS 9000 (Part 15) : 1982*' *for* '**7.15.2** of IS 589 : 1961'.

(*Page* 18, *clause* **13.5.2.1**, *line* 2) — Substitute 'IS 9000 (Part 15) : 1982*' *for* '**7.15.3** of IS 589 : 1961'.

(*Page* 18, *clause* **13.6.2**, *line* 2) — Substitute 'IS 9000 (Part 11) : 1983†' *for* '**7.10** of IS 589 : 1961'.

(*Page* 18, *clause* **13.7.1**, *lines* 1 *and* 2) — Substitute 'IS 9000 (Part 10) : 1979‡' *for* '**7.9** of IS 589 : 1961'.

(*Page* 18, *foot-note with* '*' *mark*) — Substitute the following for the existing matter:

'*Basic environmental testing procedures for electronic and electrical items : Part 15 Sealing test.

†Basic environmental testing procedures for electronic and electrical items : Part 11 Salt mist test.

‡Basic environmental testing procedures for electronic and electrical items : Part 10 Mould growth test.'

(LTD 7)

Reprography Unit, BIS, New Delhi, India